THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

CERTIFICATE IN CONSTRUCTION TECHNICIAN II

AMA 1110: CERTIFICATE GEOMETRY I

END OF SEMESTER EXAMINATION

SERIES: AUGUST/SEPTEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*
- *Scientific calculator*

This paper consists of **FIVE** questions in **TWO** sections **A** & **B**
Answer question **ONE** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

SECTION A (COMPULSORY)

Question 1

a) Three forces of magnitudes 300KN, 250KN and 100KN at a point in the same plane at 30º, 120º and 240º from the horizontal respectively. Determine:

   (i)   Magnitude of resultant force

   (ii)   The angle between the resultant force and the 100KN force   (11 marks)

b) Two velocities are expressed as:

   $$\underset{\sim}{V} = 3\underset{\sim}{i} + 6\underset{\sim}{j} - \underset{\sim}{k} \qquad \underset{\sim}{V_2} = 2\underset{\sim}{i} + \underset{\sim}{j} + 2\underset{\sim}{k}$$

   Determine:

   (i)
   $$\underset{\sim}{V_1} + \underset{\sim}{V_2}$$

   (ii)
   $$\left| V_1 + V_2 \right|$$

   (iii)
   $$\left| \underset{\sim}{V_1} \right| \ and \ \left| \underset{\sim}{V_2} \right|$$

   (iv)   The angle between the vectors   (7 marks)

c) Figure 1 shows cross-section of a culvert that was laid across a road 4m in diameter, find:
   (i)   Volume of water the culvert conveys when full
   (ii)   Volume of the concrete material used in the construction   (12 marks)

0.45m

SECTION B (Answer *any TWO questions from this section*)

Question 2

$$a = i + 2j + 3k \quad and \quad b = 3i + 4j - 5k$$

a) Given
   Determine:

   (i) $a \bullet b$

   (ii) $\left| a + b \right|$

   (iii)   The angle between a and b (9 marks)

b) The roof of a tunnel spans 4m and has a maximum rise of 0.2m high. Determine:

   (i)   Surface area of the roof

   (ii)   Volume of air in the tunnel   (11 marks)

Question 3

a) A water tank is shaped in the form of frustrum of a cone base radius 5m. The tank has an upper
   radius of 3m and a vertical height of 4m. Find:
   (i)   The capacity of the tank
   (ii)   Surface area of for the curved surface   (12 marks)

$$F = 3\underset{\sim}{i} + 2\underset{\sim}{j} - \underset{\sim}{k}$$

b) A force   on an object displaces the object from point P to point Q. The coordinates of p and Q are (2,4,3) and (5, 2, -1) respectively.

    Find:

    (i)   Work done by the force
    (ii)   Moment for the force applied   (8 marks)

Question 4

a) a log 4m long has a portion cut off along its entire length. The maximum thickness of the off-cut is 0.08m length. The maximum thickness of the off-cut is 0.08m as shown in figure 2. Find:
    (i)   volume of the off cut
    (ii)   area of the curved
                                                   (10 marks)

Fig 1.0

0.35m

$$P = 3\underset{\sim}{i} + 2\underset{\sim}{j} - \underset{\sim}{k} \quad and \quad Q = \underset{\sim}{i} - \underset{\sim}{j} + \frac{1}{2}\underset{\sim}{k}$$

b) (i) Given
           $\underset{\sim}{P} \times \underset{\sim}{Q}$
    Find

$$F = 2\underset{\sim}{i} + \underset{\sim}{j} - \underset{\sim}{k}$$

    (ii)   A force   Newtons acts on a line passing through a point A. Find moment M and its magnitude about point B. The co-ordinates for points A and B are (1, 2, 3)M and (0, 1, 1) respectively.

    (iii)   Find work done by force in b(ii)   (10 marks)

Question 5

a) (i) Show that the angle between two straight lines that slopes at M_1 and M_2 to the horizontal can

$$Q = arc \ \tan\pm \frac{m_1 - m_2}{1 + m_1 m_2}$$

be expressed in the form:

(ii) Deduce from a) (i) that for parallel lines $M_1 = M_2$ (8 marks)

b) Show that the standard equation for parabola can be expressed in its simplest form as:

$$y = 4ax$$

(6 marks)

c) Two forces of magnitudes 200N and 100N act at a point in the same plane. The angle between the forces is 45° 40', while 200N force is in the horizontal.

Find:

(i) The resultant force
(ii) The direction in which resultant acts from the 100N force (6 marks)